

# Master of Public Health Field Experience Report

## A LOOK INTO THE EMPHASIS PHYSICIANS, VETERINARIANS, AND PREGNANCY EDUCATORS PLACE ON PROVIDING TOXOPLASMOSIS INFORMATION FOR PREGNANT PATIENTS OR CLIENTS

by

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## **Abstract**

The mission of the Hunterdon County Health Department is to ensure the health and safety of the public. The purpose of the following paper is to discuss the knowledge and emphasis human and veterinary medical professionals place on educating patients and clients about toxoplasmosis. Toxoplasmosis is caused by a parasite that commonly affects both people and animals. This paper discusses the knowledge of health professionals about toxoplasmosis and the recommendations they make to pregnant clients about toxoplasmosis testing and ways to prevent transmission. A total of 17 veterinarians, 10 physicians, and 6 pregnancy educators responded to a survey regarding toxoplasmosis. The emphasis that health professionals place on discussing the risks of toxoplasmosis transmission with pregnant clients varies over a wide range. The results of this project confirm that most physicians and veterinarians discuss toxoplasmosis with patients and clients; however, a smaller percentage of pregnancy educators do so. Pregnancy educators also place a lower priority on such discussion than do physicians and veterinarians. The data support the fact that health professionals believe patients and clients have a low awareness of toxoplasmosis and its hazards. Knowledge about toxoplasmosis among health professionals is mixed at best with veterinarians having the most complete working knowledge. The survey results support strongly the need for educational tools for use in communicating the risks of toxoplasmosis to patients and clients.

**Subject Keywords:** Toxoplasmosis, *T. gondii*, pregnancy, oocyst, parasite, veterinary, human, cat, soil, meat, medical, professional

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# **Chapter 1 - Introduction: The Hunterdon County Health Department**

During the summer of 2014, I had the privilege of working under the health officer and infectious epidemiologist, Karen Demarco at Hunterdon County Health Department located in Flemington, NJ. Mrs. Demarco introduced me to the entire team of public health officials, field workers, and public health nurses. I was also able to work with some of the staff in the entomology department, mosquito vector department, and with public health nurses.

The goal of the project was to address the emphasis veterinarians, physicians, and pregnancy educators place on toxoplasmosis education of their pregnant patients or clients. Pregnancy educator refers to those who are seen as a source of education and information for pregnant women, such as nurses or Lamaze instructors. This was assessed through a short 16 question survey that evaluated their knowledge of toxoplasmosis, the emphasis they place on toxoplasmosis education, the percentage of patients or clients that request toxoplasmosis education, and their likelihood to utilize educational tools. We also developed two educational tools that could be used; a brochure that patients or clients could take home with them, and a PowerPoint presentation designed to be presented at pregnancy classes or “Lunch and Learn” settings.

I received a well-rounded experience at the Hunterdon County Health Department. I had the opportunity to work across many departments in addition to my research in toxoplasmosis.

## **Chapter 2 – A Survey Review of Toxoplasmosis Education**

### **Literature Review**

Toxoplasmosis is caused by a single-celled parasite, *Toxoplasma gondii* that is found throughout the world. The parasite has a three stage lifecycle. The first phase the sexual phase, which occurs in the cat intestine and produces infective oocysts. When an animal ingests infective oocysts, the organism becomes a rapidly dividing tachyzoite within the cells of the host animal. As the hosts immune system mounts an attack, division of tachyzoites is slowed and they encyst in the tissues as bradyzoites. The cycle continues when a cat consumes the tissue of an infected host leading to activation of the bradyzoites to produce oocysts (Lappin, 2002).

Transmission of *T. gondii* occurs in a variety of ways. The most common mode of transmission is by eating undercooked and contaminated meat. The parasite is most commonly found in pork, mutton, and venison and transmission occurs via ingestion of *T. gondii* contaminated raw or undercooked meat. It is also possible to ingest the parasite after handling contaminated meat without proper hand washing or by eating food with contaminated utensils that were in contact with contaminated raw meat. *T. gondii* may also contaminate water sources. *T. gondii* is spread by contact with contaminated cat feces. Infection may occur when cleaning the litter box, touching anything that has come into contact with cat feces, or accidental ingestion of *T. gondii* contaminated soil when hands are not washed after gardening. Pregnant women can spread the parasite to their unborn child. In very rare cases, toxoplasmosis can be contracted from an infected organ transplant or infected blood via a transfusion. (Parasites - Toxoplasmosis (*Toxoplasma* infection), 2013)

A study performed by Jones et. al, showed that of 403 pregnant women surveyed, 48% had seen some information about toxoplasmosis but only 7% were aware that they could be tested for toxoplasmosis. The low level of patient education regarding toxoplasmosis, may reflect the level of knowledge of nurses and physicians

assisting pregnant women. In a study done by Berriel da Silva et al., they distributed a survey to 61 physicians and 56 nurses. Ninety-seven percent of respondents recognized that cats are a potential source of infection and 51.7% believed dogs were as well. The largest error in education came in recognizing raw contaminated vegetables as a source of infection. In another study done by Kravetz and Federman, 102 obstetricians, internists and family practitioners were surveyed to assess their knowledge of risk factors of toxoplasmosis transmission. Obstetricians were more likely to advise against undercooked meat and gardening without gloves, the two most common modes of transmission, than internists or family practitioners. Twenty-five percent of all participants suggested pregnant women avoid all cat contact.

The majority of people who contract toxoplasmosis experience mild to moderate flu-like symptoms. Symptoms can be more severe in those who are immune-compromised. Symptoms may include lymphadenitis, chorioretinitis, or toxoplasmic encephalitis (Montoya, 2004). The real concern is the effect toxoplasmosis has on an unborn child. It has been documented that children born to mothers infected with *Toxoplasma gondii* during pregnancy were born with varying forms of mental retardation and blindness (Wallon, 1999). Blindness in newborns results from a form of the disease called toxoplasmic chorioretinitis. This form of toxoplasmosis can result in acute reactivation of infection (Montoya, 2004). Despite extensive research into the proper way to treat this congenital infection, a treatment that works effectively and consistently has not been identified. Some evidence shows spiramycin and sulphonamide may be useful in preventing vertical transmission of the disease, however the findings are inconsistent (Wallon, 1999).

## Survey Objectives

The objective of this study was to survey health professionals having contact with pregnant patients. The questions were aimed at determining the respondents knowledge of the life cycle, routes of transmission, and proper recommendations made to clients on prevention of the disease, the priority they place on toxoplasmosis education, and overall toxoplasmosis awareness. This study was conducted under the guidance of those at the Hunterdon County Health Department. Approximately 100 surveys were distributed to pregnancy educators, veterinarians, and obstetrician gynecologists within Hunterdon County, New Jersey. Six pregnancy educators, 17 veterinarians, and 10 OBGYNs responded to the survey. The results from the survey are pictured in the following figures.

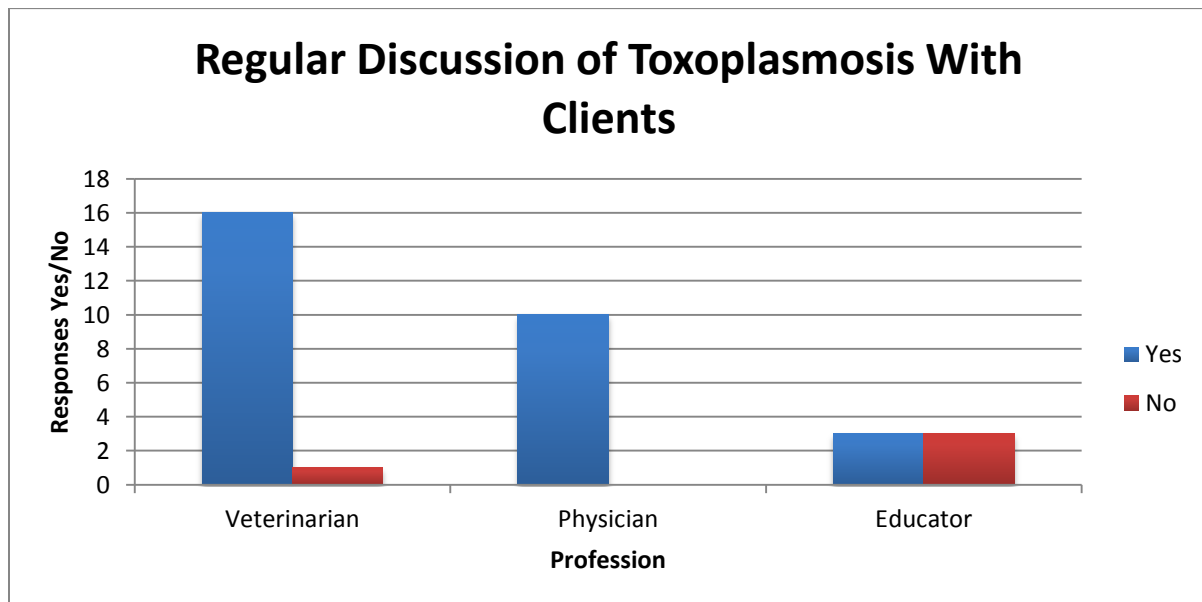


Figure 2.1. Physicians, veterinarians, and pregnancy educators were asked if they regularly discussed toxoplasmosis with pregnant clients. The above graph describes the number of yes and no responses to the previous question.



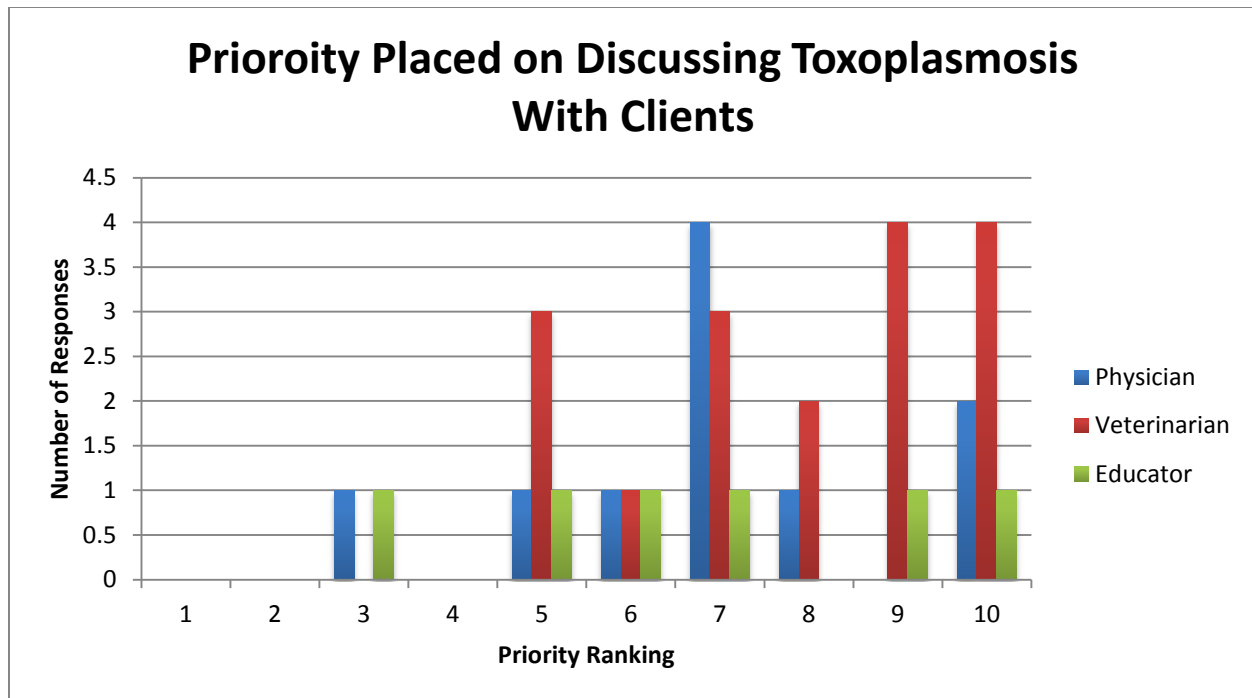


Figure 2.2. Physicians, veterinarians, and pregnancy educators were asked to rank the priority they place on discussing toxoplasmosis with clients with 1 being not important and 10 being very important. The number of responses by profession are listed under each priority ranking.

Figure 2.1 indicates the likelihood that medical professionals will discuss toxoplasmosis with pregnant clients while Figure 2.2 shows the priority they place on this discussion. Most veterinarians and physicians said they discuss toxoplasmosis with pregnant clients. Half of pregnancy educators said discussed toxoplasmosis with pregnant clients. Figure 2.2 shows that veterinarians ranked importance of this discussion from 5-10. Physicians and pregnancy educators ranked priority of the discussion at 3-10.

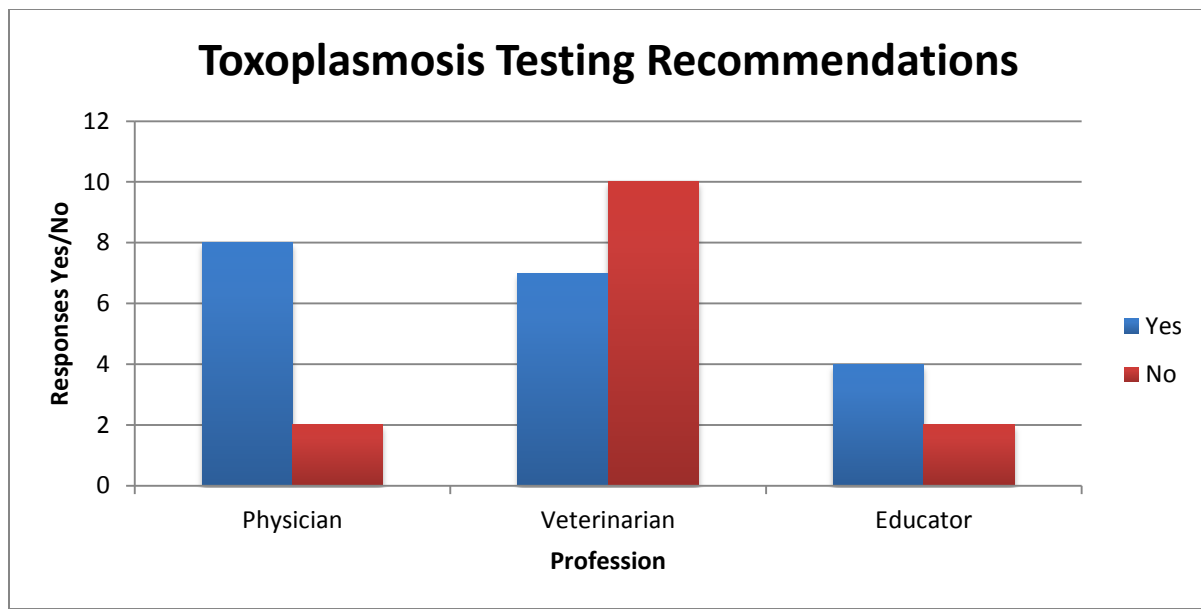


Figure 2.3. Physicians, veterinarians, and pregnancy educators were asked if they recommend testing for toxoplasmosis to their pregnant clients. The number of yes/no responses are described by profession.

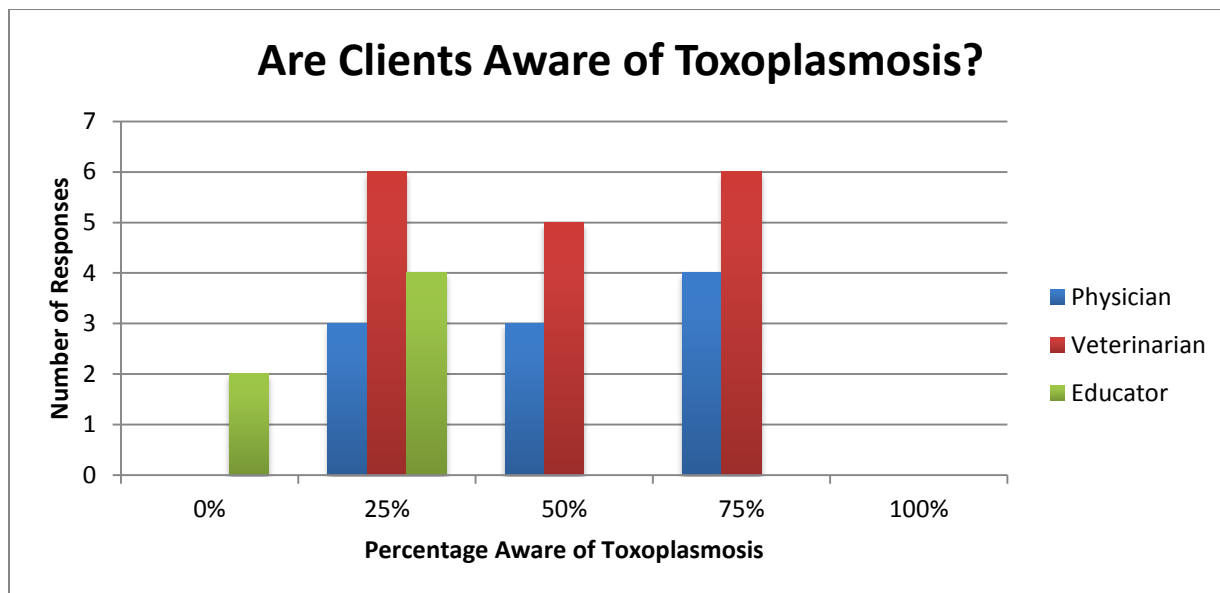


Figure 2.4. Physicians, veterinarians, and pregnancy educators were asked what percentages of pregnant clients were aware of how toxoplasmosis could affect them. The number of responses are listed per profession for each percentage category.

Figure 2.3 presents results for the question of whether medical professionals discuss toxoplasmosis testing with pregnant clients. Veterinarians represent the profession for which a greater percentage do not suggest testing compared with those who do suggest testing. There is a greater percentage of physicians that do suggest testing over those that do not. Figure 2.4 presents the percentage of clients, as estimated by the health professional, that are aware of toxoplasmosis. Those that see pregnancy educators are estimated to be least aware of toxoplasmosis and 25-75% of those that discuss toxoplasmosis with their doctor or veterinarian are aware of the disease.

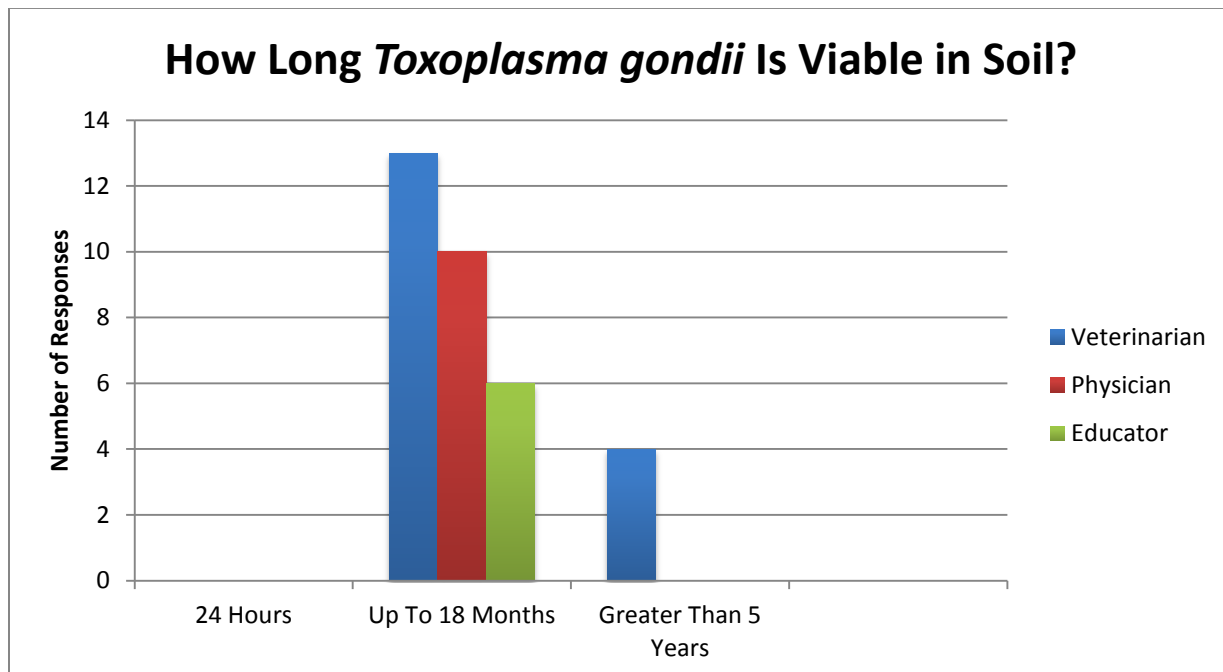


Figure 2.5. Physicians, veterinarians, and pregnancy educators were asked how long *Toxoplasma gondii* is viable in the soil to assess their knowledge of the disease. The number of responses for each category described above by profession.

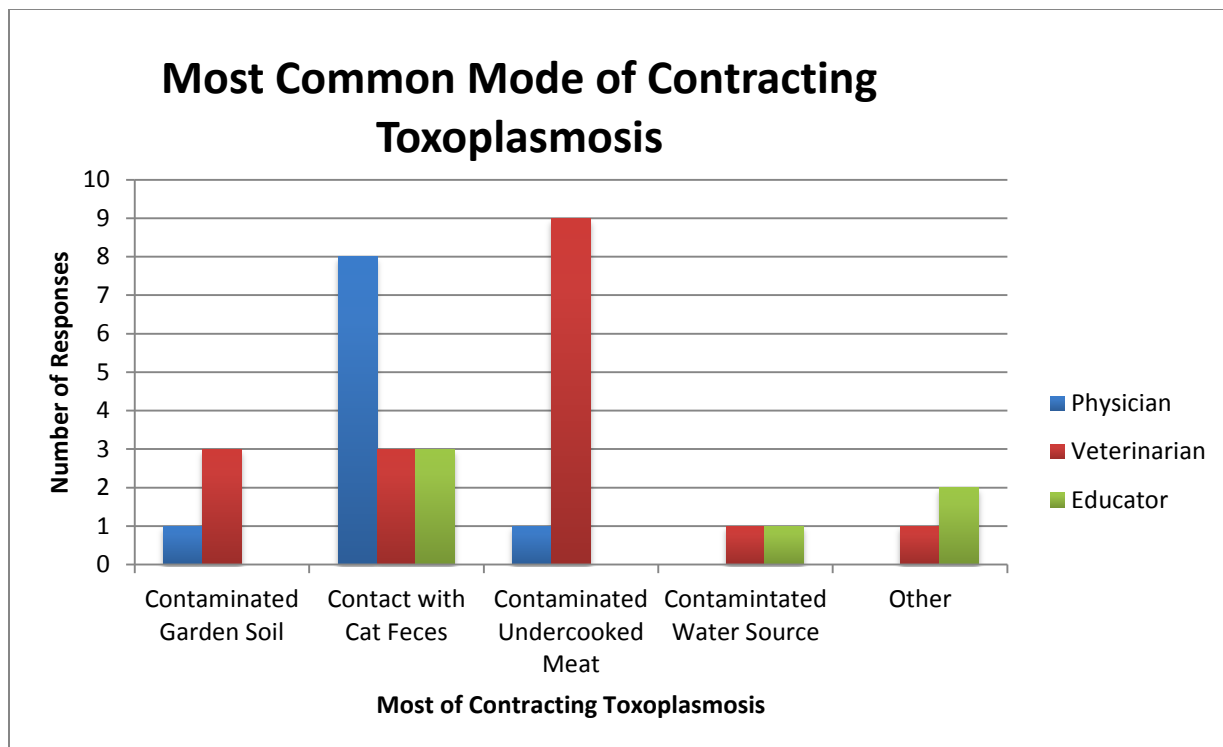


Figure 2.6. Physicians, veterinarians, and pregnancy educators were asked what they thought was the most common mode of contracting toxoplasmosis. The number of responses per profession are described by each category.

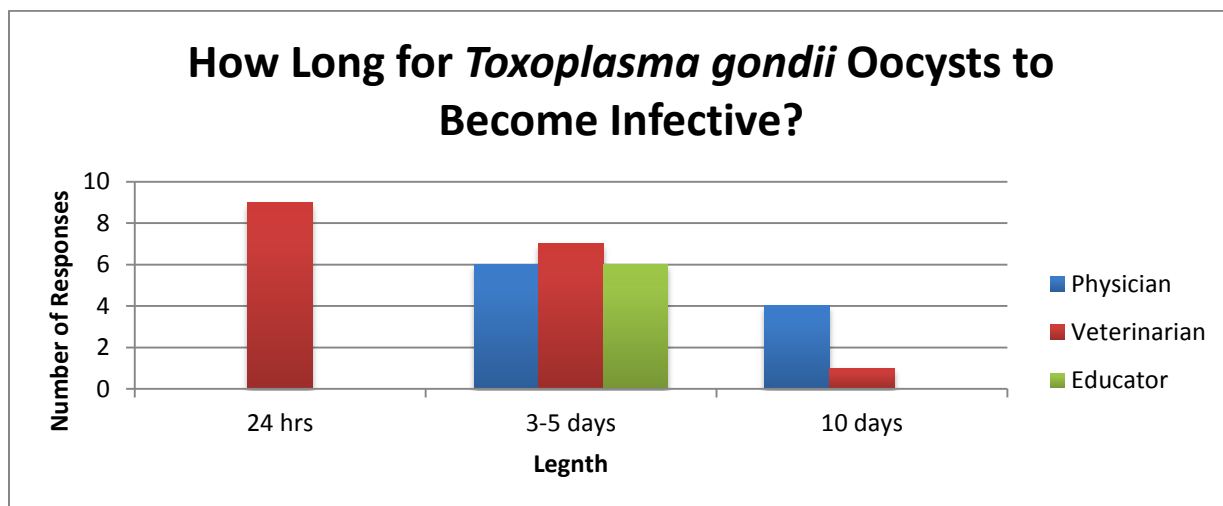


Figure 2.7. Physicians, veterinarians, and pregnancy educators were asked how long it takes *Toxoplasma gondii* oocysts to become infective. The number of responses per profession are described for each length of time.

The purpose of the questions from Figures 2.5, 2.6, and 2.7 was to assess respondents knowledge of toxoplasmosis. The majority of health professionals were correct in knowing *Toxoplasma gondii* is viable in the soil for up to 18 months. There were 4 physicians who believed it was viable for greater than 5 years. Figure 2.6 shows what health professionals believed was the most common way to acquire toxoplasmosis. With all answers are possible ways of contracting toxoplasmosis, contaminated undercooked meat is the most common mode of transmission. Veterinarians were the most likely to choose the correct answer. A common response was that toxoplasmosis is contracted from contact with contaminated cat feces. While this is a possibility, it is not the most common route based on the life cycle of the parasite Figure 2.7 shows the results from asking how long it took for oocysts to become infective. Veterinarians were the only respondents who selected the correct answer (24 hours for oocysts to become infective). This is an important piece of information to share with clients since transmission from cat feces can be greatly reduced if the litter is cleaned every day. Physicians as well as veterinarians also chose the incorrect answers stating it takes 3-5 days and 10 days for oocysts to become infective.

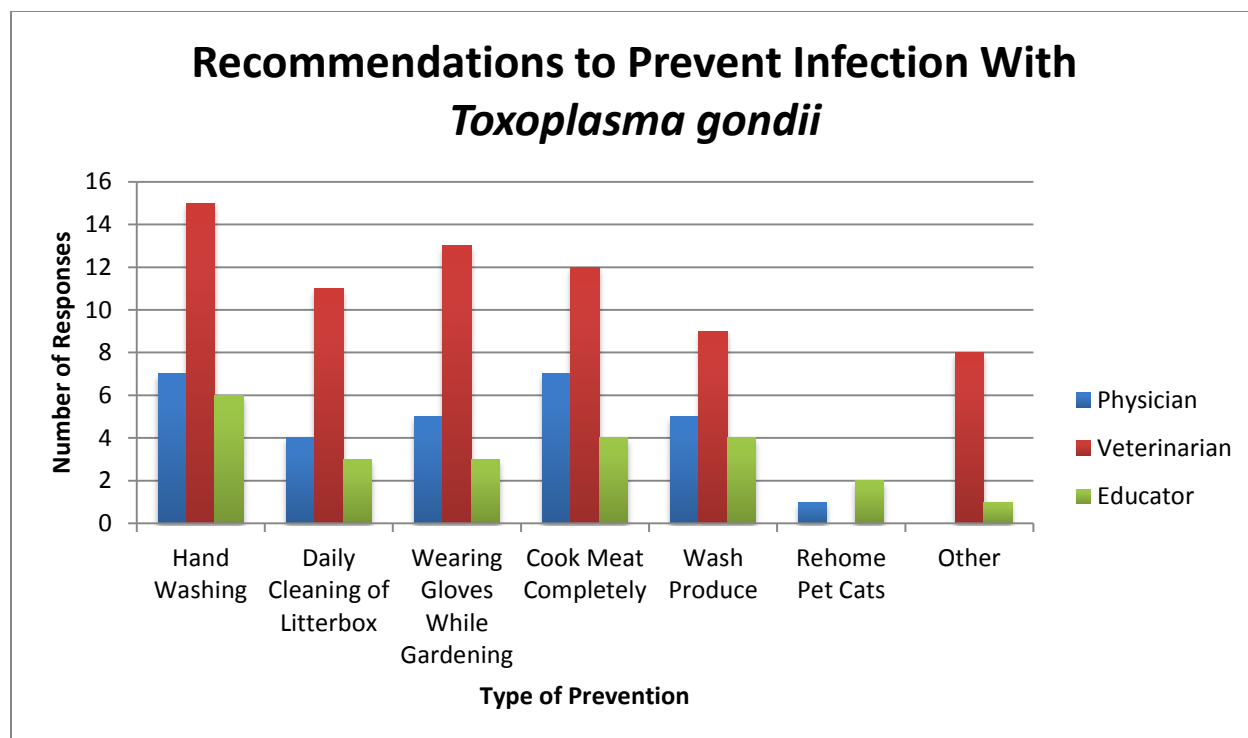


Figure 2.8. Physicians, veterinarians, and pregnancy educators were asked what recommendations they make to their pregnant clients in preventing *Toxoplasma gondii* infection. The number of responses are listed per profession under each category.

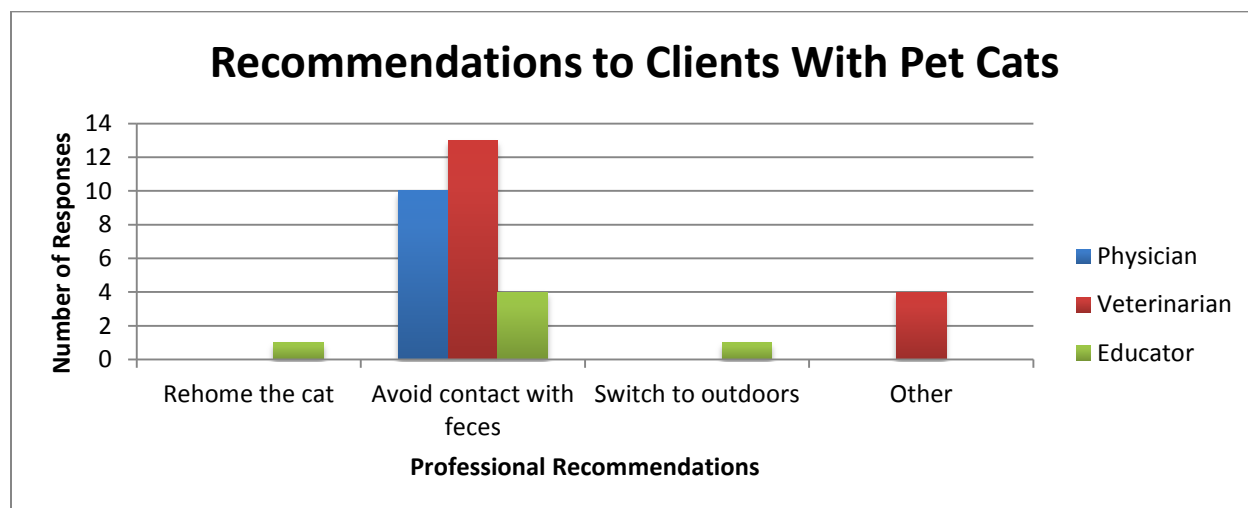


Figure 2.9. Physicians, veterinarians, and pregnancy educators were asked what their recommendations to pregnant clients were on how to manage a pet cat in the household. The number of responses per profession are described for each recommendation.

Figures 2.8 and 2.9 show results from questions designed to see what recommendations are made to prevent *Toxoplasma gondii* infection. Figure 2.8 shows recommendations across all options. This question had the option of choosing more than one response. This is because many of the responses are correct ways to prevent transmission. However, there is one incorrect answer. Cats are responsible for shedding oocysts for 1-2 weeks of its life making the chances of contracting toxoplasmosis from a pet cat very unlikely. Rehoming a pet cat was recommended by 2 physicians and one pregnancy educator. Figure 2.9 shows recommendations to people who specifically have pet cats. Again one pregnancy educator selected rehoming the cat, not a recommendation. One pregnancy educator also selected switching the cat to an outdoor life style, a recommendation that could predispose the cat to contracting toxoplasmosis if it does not have the disease already. The correct recommendation is to avoid contact with cat feces.

There are differences in knowledge about toxoplasmosis education both within and between professions. Veterinarians are most likely to answer questions correctly but aren't always the ones providing the information to clients. There can be reluctance of those having the information for presenting that information to a client that is not a patient. Some veterinarians may feel as though it is not their responsibility to inform clients on human medical needs. It is important for the human medical professional community to be just as aware of this zoonotic disease as veterinarians. Those in the public health profession should strive for all medical professionals to be equally aware of the risks and prevention measures taken to avoid transmission of this disease to pregnant women. It is equally the responsibility of the physicians, veterinarians, and pregnancy educators.

A common concern people have is whether or not they need to re-home their pet cats once becoming pregnant. The minority of survey takers responded with this as a way to control the zoonotic spread of toxoplasmosis. Three out of the 33 respondents suggested re-homing as a necessary precaution. A total of 31/33 did cite avoiding contact with cat feces as a recommendation to pregnant clients. Veterinarians were more likely to correctly identify undercooked contaminated meat as the most common

cause of toxoplasmosis transmission to humans (11/17), while 0/6 pregnancy educators and only 1/10 physicians correctly identified meat as the most common cause of transmission. Veterinarians were also more likely to correctly identify *Toxoplasma gondii* oocysts as taking 24 hours to become infective (9/17), whereas 1/6 pregnancy educators and 0/10 physicians answered correctly. When asked how long oocysts remain in the environment, 6/6 pregnancy educators, 13/17 veterinarians, and 10/10 human medical professionals answered correctly with 18 months.

It can be concluded that medical professionals interacting with pregnant clients are well informed on the recommendations to make to those clients to prevent transmission, especially with regards to cats. However, few respondents had a good understanding regarding the most common routes of transmission and information related to the parasite's life cycle. Understanding these aspects of the disease are important in making well-rounded recommendations for disease transmission prevention. Covering one aspect of disease prevention doesn't completely eliminate the risks of transmission. All sources must be investigated and the proper measures taken to avoid contact with the parasite.

It is important that all aspects of the health profession be intimately involved in education of the public on zoonotic diseases. It is not just the responsibility of one component of the health professions. It is a common assumption by the health community that it is the requirement of veterinarians to educate their clients on zoonotic diseases they may obtain from their pets or wildlife. When surveyed, 28 out of the 33 respondents said they would use an informative brochure or educational aid on toxoplasmosis and 22 said they felt this survey would increase the likelihood of discussing the risks of toxoplasmosis with their pregnant clients.

There were several obstacles to overcome during the study. The biggest obstacle was getting a suitable response rate to the survey. I accomplished this by friendly reminders about completing the survey and emphasizing the importance of helping a graduate student with her research. It was sometimes difficult to interpret the results of the survey. Most respondents replied to each question to the best of their ability, and some simply did not respond to questions for which they didn't know the answer. This made interpreting the results of the survey challenging. The lack of



knowledge and disease prevalence in the area also came as a hurdle. Because toxoplasmosis is not a reportable disease, there was not much information on how big a problem the disease was in the area.

## **Chapter 3 – Internship Overview**

### **Learning Objectives**

Before my arrival at the Hunterdon County Health Department, I was given with the task to develop a list of learning objectives to be completed during my internship. Mrs. Demarco and I brainstormed some ideas regarding a project we could develop. We focused on developing a survey to administer to human and veterinary health professionals concerning zoonotic diseases common to the area. We decided on toxoplasmosis as the zoonotic disease. It was our goal to evaluate the knowledge the medical professionals had concerning toxoplasmosis and the emphasis they placed on educating the public on the disease.

### **Activities Performed**

While undertaking my field experience at the Hunterdon County Health Department I was able to experience and perform numerous public health activities. Within my first week, I attended a lecture on public health entomology. Dr. John Wallace from Millersville University spoke on general entomology and gave some insight into how insects play a role in decomposition of carcasses. We were then invited to an outdoor site where the health department had gathered two white tailed deer that had been hit by cars. We observed the number of insects present, the species present, and what stage in development the maggots were.

I attended a “Lunch and Learn” for senior citizens. The topic was food-borne illness. We provided lunch while the attendees listened to my advisor present a

PowerPoint presentation. I think the senior citizens really enjoyed this program. They had lots of questions and seemed to learn a lot from the experience. It was very rewarding to watch such a positive and engaging conversation between the public and the educators.

The following week I was invited to spend a day in the mosquito vector department. In the morning I was involved in separating collected mosquitos into their different species. They were then placed into vials and sent to the state health department for testing. Later that morning I accompanied the field team in the field to set traps for more mosquito collection. In the afternoon I entered the data from previous mosquito collections into an Excel spreadsheet. It contained information on the location the mosquitos were collected, the species, and the number collected of each species.

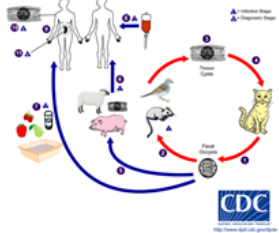
The following week I spent a day with the public health nursing department. They were in charge of pregnancy education and support for the community. This allowed me to ask some questions regarding my project. I was also able to become involved in a house call. We were visiting a woman who had a baby a few weeks earlier. The public health nurses were concerned that she may be suffering from some post partum depression. We visited her house for about 2 hours. She was a Spanish-speaking client, much like most of their clients, so I wasn't always able to understand the conversation. I was, however, able to understand the overall conversation and what was troubling the woman. It made me feel good to visit her home and help brighten her day some. The rest of my time at the health department was spent doing research on toxoplasmosis, developing a survey, distributing and collecting the survey, and developing some educational tools regarding toxoplasmosis for use by the health department.

## **Products Developed**

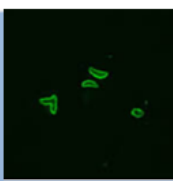
In my time at the Health Department, I spent considerable time researching toxoplasmosis. My survey allowed me to see the disconnect in toxoplasmosis education and, therefore, I was able to target my educational tools to touch on those subjects. I first developed an educational brochure (see Figure 3.1). It was my hope that physicians, veterinarians, and pregnancy educators could offer a concise and easy to understand brochure that patients were able to take home with them. I then developed a PowerPoint presentation for use in “Lunch and Learn” settings (see appendix 2).

### What is toxoplasmosis?

The cause of toxoplasmosis is a single-celled parasite called *Toxoplasma gondii*. It can be found anywhere in the world. Toxoplasmosis is the second deadliest food-borne illness known. The most common way to contract toxoplasmosis is by eating raw or undercooked meat contaminated with *Toxoplasma gondii*. This especially applies to pork, mutton, and venison. *Toxoplasma gondii* also resides in the feces of infected cats. Cats only shed the parasite in their feces for about 2 weeks. Therefore, there is a small window of opportunity to contract toxoplasmosis from a pet cat. On the other hand, the parasite can survive in the soil for up to 18 months, making gardening a common mode of contracting toxoplasmosis.



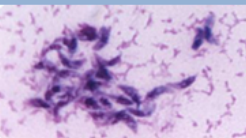
**CDC**  
http://www.cdc.gov/gonidia



www.cdc.gov

### Can I be tested for toxoplasmosis?


Testing for antibody titers to *Toxoplasma gondii* are available to those who are pregnant or planning on becoming pregnant. If the test comes back positive, then at some point you have been infected with the parasite. This means that you have developed an immune response to keep the infection in check and there is little concern of passing the infection to your child. If the test comes back negative then the proper precautions must be taken to avoid infection before and during pregnancy.



www.cdc.gov

## Toxoplasmosis

### The Facts for Pregnant Women





**Figure 3.1 Toxoplasmosis public educational brochure.**

## **Review of Internship**

My time at the Hunterdon County Health Department was a productive learning experience. I was exposed to more opportunities than I could have imagined. In addition to my internship project, I was also able to spend some time in a few of the many divisions within the health department.

My first experience was with the lecture on forensic entomology. It was beneficial to get out into the field and see entomology in practice using two deer that had been hit by cars. We were able to use the knowledge we learned from the lecture and apply it to the insects on the deer.

I also had the opportunity to watch my mentor in action as she gave a “Lunch and Learn” lecture to senior citizens on food-borne illness. This experience gave me the idea to add an educational PowerPoint on toxoplasmosis as part of my project.

My next experience involved working with the mosquito vector division. This was another opportunity to get out in the field. As we set up traps for mosquitos, I had an

opportunity to learn where the best environments to set traps are and how to build a device to successfully trap mosquitos. I was also tasked with separating mosquitos to be sent to the state lab and inputting data on the number of mosquitos, type of mosquito, where the mosquitos were found, and on what date they were found into an Excel spreadsheet for their records. This was a valuable experience and helped me to understand the day-to-day workings of a division of the health department.

My final experience outside of my project was a day with the public health nurses. This allowed me another opportunity to work in the field. I accompanied two public health nurses to a home visit. It was an amazing opportunity because it gave me the first feeling on making a difference. The woman we visited was struggling with post-partum depression, and I believe our visit helped her. We offered to set up doctor appointments for her and informed her of places she could go to talk about her struggles. We were also able to do a quick exam of her surgical incision and check to see she was healing properly. I feel as though just our visit and company helped her tremendously.

My internship experience was educational as well. I was able to develop a survey, compile the data, and develop learning tools for prevention of toxoplasmosis. Working in the health department was my first time working in an office setting. It was an adjustment from what I was use to. There were times when I felt like I was left in a cubicle and forgotten. My mentor was able to help me with approval of my survey from the Kansas State University Institutional Review Board. As I developed my survey, I would send copies to Mrs. Demarco and she would send back feedback. Other than this little bit of guidance, I felt very on my own for the project. If I were to do the field experience again, I would try to get in on a different department that had a project up and running that I would be able to join. I think this would allow me to become more involved in the department and I would learn more from the experience.

## Culminating Experience

My experience at the Hunterdon County Health Department encompassed many of the competencies addressed by the Master of Public Health degree program. The following describes how each core and elective classes in my curriculum aided in a successful field experience.

### 3.1: Core Competencies

Biostatistics has been critical in the analysis of the toxoplasmosis survey. Being able to organize data, knowing what statistical tests to perform, and recognizing significant findings is crucial to a successful scientific study.

The prevalence of toxoplasmosis is key to understanding its spread throughout populations. Epidemiology was central to success of this study. Because of my knowledge in epidemiology, I was able to define a population that I wanted to target for my study.

Environmental Health Sciences is important for understanding how diseases behave in the environment and how that contributes to their spread.

Toxoplasmosis can spend up to 18 months in the environment. This contributes to the ease of spread of toxoplasmosis. Understanding how the environment contributes to the *Toxoplasma gondii* life cycles is critical to understanding how we may intervene to prevent the spread of disease.

Health Services Administration provided the education and skills to use the information I acquired through my research to create educational tools for the general public. It also helped me to become better adjusted to the health department setting and to understand how the health department is run.

Social Behavioral Sciences address roles of cultures in processing food and changing litter. Certain cultural behaviors may predispose a population to contracting toxoplasmosis. Some cultures may eat undercooked foods or may be more likely to own a cat.

### 3.2: Elective Competencies

Immunology is important to understanding those more susceptible to acquiring toxoplasmosis. In addition, immunology was crucial in understanding how *Toxoplasma gondii* is spread to a fetus and why women with a *Toxoplasma gondii* titer are much less likely to spread the disease to their unborn children.

Parasitology is at the core of understanding toxoplasmosis as *Toxoplasma gondii* is a parasite itself. Further toxoplasmosis research could help us to better understand ways to prevent spread of the parasite to a fetus should a mother become infected while pregnant. There are very few treatments available that have much success in preventing the spread of *Toxoplasma gondii* to the unborn children.

Animals have a central influence on the spread of toxoplasmosis. Veterinary Epidemiology aids in understanding how animals play a role in the disease process. It offers another point of intervention and prevention.

It is difficult to tie Environmental Toxicology into toxoplasma research. But the environment does influence toxoplasmosis transmission as the oocysts can remain viable in the soil for up to 18 months.

The immune system of animals carrying toxoplasmosis plays an important role in its spread. This is why Immunology of Domestic Animals was key to my learning and expanding my knowledge of toxoplasmosis.

Food Protection and Defense is central to preventing the spread of disease. *Toxoplasma gondii* is primarily spread through undercooked food. This makes food protection and defense a primary intervention strategy for the spread of *Toxoplasma gondii*. Ensuring that public is aware of the safety precautions needed to prevent infection with *Toxoplasma gondii* is crucial to stopping the spread of this disease.

Similar to Introduction to Epidemiology, Intermediate Epidemiology enhanced my understanding of how diseases spread through a population. Intermediate Epidemiology was a more in-depth and detailed class adding more to my knowledge in epidemiology.

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## **Appendix- Products Developed**

### **Appendix A - Survey**

Is Toxoplasmosis a Serious Threat to the Health of Pregnant Women?

My name is Caitlin Timmins. I am a Master of Public Health program and Doctor of Veterinary Medicine student at Kansas State University. As part of my MPH, I am required to complete 240 hours of field experience in the public health field. I have chosen to undertake research regarding the priority and knowledge of toxoplasmosis to the community that educates pregnant women on this disease. It is my goal to utilize the data from this survey to develop public health awareness tools to educate pregnant women on the dangers of toxoplasmosis and on prevention measures. Please fill out the following survey as honestly as possible. Your responses are key to this research and are greatly appreciated.

#### Introduction Survey

Which of the following best describes your profession?

- ☐ Obstetrician/ Gynecologist
- ☐ Physicians Assistant
- ☐ Nurse
- ☐ Pregnancy Educator
- ☐ Veterinarian

Do you own or have you ever owned a cat?

- ☐ Yes
- ☐ No

In your experience, which of the following have you observed to be the most common mode of contracting toxoplasmosis?

- ☐ Gardening in soil contaminated with cat feces
- ☐ Contact with infected fecal material from a cat
- ☐ Contaminated raw or undercooked meat
- ☐ Contaminated water source
- ☐ Other \_\_\_\_\_.

Which situation do you think poses the greatest risk for toxoplasmosis transmission?

- ☐ A feral cat using a sand box as a litter box
- ☐ A strictly indoor pet house cat
- ☐ An indoor-outdoor pet cat
- ☐ A newly adopted kitten
- ☐ Other \_\_\_\_\_.

#### Toxoplasmosis Survey – Human Medical Physicians

Is toxoplasmosis a disease that you regularly discuss with pregnant patients?

- ☐ Yes                      ☐ No

Please rate the priority you place on discussing toxoplasmosis with pregnant patients (1 being the least priority and 10 being the highest priority).

- ☐ 1   ☐ 2   ☐ 3   ☐ 4   ☐ 5   ☐ 6   ☐ 7   ☐ 8   ☐ 9   ☐ 10

Do you recommend toxoplasmosis testing to your patients who are pregnant or may become pregnant?

☐ Yes

☐ No

What percentage of patients do you think are aware of the disease toxoplasmosis?

☐ 0%

☐ 25%

☐ 50%

☐ 75%

☐ 100%

Which of the following do you recommend to patients to prevent infection with *Toxoplasma gondii*?

☐ Hand washing

☐ Daily cleaning of litter boxes

☐ Wearing gloves during gardening

☐ Cooking meat completely in accordance with CDC recommendation

☐ Washing all produce thoroughly

☐ Re-homing any pet cats

☐ Other \_\_\_\_\_.

What is your recommendation to patients concerned about the risks associated with their pet cat?

☐ To re-home the cat

☐ To avoid contact with cat feces

☐ To switch the cat to an all outdoor lifestyle

☐ Other \_\_\_\_\_.

In your experience, how long does it take for *Toxoplasma gondii* oocysts to become infective?

- ☐ 24 hours
- ☐ 3-5 days
- ☐ 10 days

In your experience, how long do viable *Toxoplasma gondii* oocysts remain infective in the soil environment?

- ☐ 24 hours
- ☐ Up to 18 months
- ☐ More than 5 years

#### Toxoplasmosis Survey – Veterinarians

Is toxoplasmosis a disease that you regularly discuss with pregnant clients?

- ☐ Yes
- ☐ No

Please rate the priority you place on discussing toxoplasmosis with pregnant clients (1 being the least priority and 10 being the highest priority).

- ☐ 1   ☐ 2   ☐ 3   ☐ 4   ☐ 5   ☐ 6   ☐ 7   ☐ 8   ☐ 9   ☐ 10

Do you recommend toxoplasmosis testing to your clients who are pregnant or may become pregnant?

- ☐ Yes
- ☐ No

What percentage of clients do you think are aware of the disease toxoplasmosis?

- ☐ 0%      ☐ 25%      ☐ 50%      ☐ 75%      ☐ 100%

Which of the following do you recommend to clients to prevent infection with *Toxoplasma gondii*?

- ☐ Hand washing  
☐ Daily cleaning of litter boxes  
☐ Wearing gloves during gardening  
☐ Cooking meat completely in accordance with CDC recommendation  
☐ Washing all produce thoroughly  
☐ Re-homing any pet cats  
☐ Other \_\_\_\_\_.

What is your recommendation to clients concerned about the risks associated with their pet cat?

- ☐ To re-home the cat  
☐ To avoid contact with cat feces  
☐ To switch the cat to an all outdoor lifestyle  
☐ Other \_\_\_\_\_.

In your experience, how long does it take for *Toxoplasma gondii* oocysts to become infective?

- ☐ 24 hours  
☐ 3-5 days  
☐ 10 days

In your experience, how long do viable *Toxoplasma gondii* oocysts remain infective in the soil environment?

- ☐ 24 hours
- ☐ Up to 18 months
- ☐ More than 5 years

#### Toxoplasmosis Survey – Pregnancy Educators

Is toxoplasmosis a disease that you regularly discuss with pregnant students?

- ☐ Yes
- ☐ No

Please rate the priority you place on discussing toxoplasmosis with pregnant students (1 being the least priority and 10 being the highest priority).

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10

Do you recommend toxoplasmosis testing to your students who are pregnant or may become pregnant?

- ☐ Yes
- ☐ No

What percentage of students do you think are aware of the disease toxoplasmosis?

- ☐ 0%
- ☐ 25%
- ☐ 50%
- ☐ 75%
- ☐ 100%

Which of the following do you recommend to students to prevent infection with *Toxoplasma gondii*?

- ☐ Hand washing
- ☐ Daily cleaning of litter boxes
- ☐ Wearing gloves during gardening
- ☐ Cooking meat completely in accordance with CDC recommendation
- ☐ Washing all produce thoroughly
- ☐ Re-homing any pet cats
- ☐ Other \_\_\_\_\_.

What is your recommendation to students concerned about the risks associated with their pet cat?

- ☐ To re-home the cat
- ☐ To avoid contact with cat feces
- ☐ To switch the cat to an all outdoor lifestyle
- ☐ Other \_\_\_\_\_.

In your experience, how long does it take for *Toxoplasma gondii* oocysts to become infective?

- ☐ 24 hours
- ☐ 3-5 days
- ☐ 10 days

In your experience, how long do viable *Toxoplasma gondii* oocysts remain infective in the soil environment?

- ☐ 24 hours
- ☐ Up to 18 months
- ☐ More than 5 years

#### Wrap-up Survey

What age range do you fall into?

- ☐ 20-30   ☐ 31-40   ☐ 41-50   ☐ 51-60   ☐ 61-70   ☐ 71-80

Do you regard toxoplasmosis as a disease worth discussing with your patients?

- ☐ Yes                      ☐ No

Would you utilize an informative brochure or other education aid regarding toxoplasmosis if it were available?

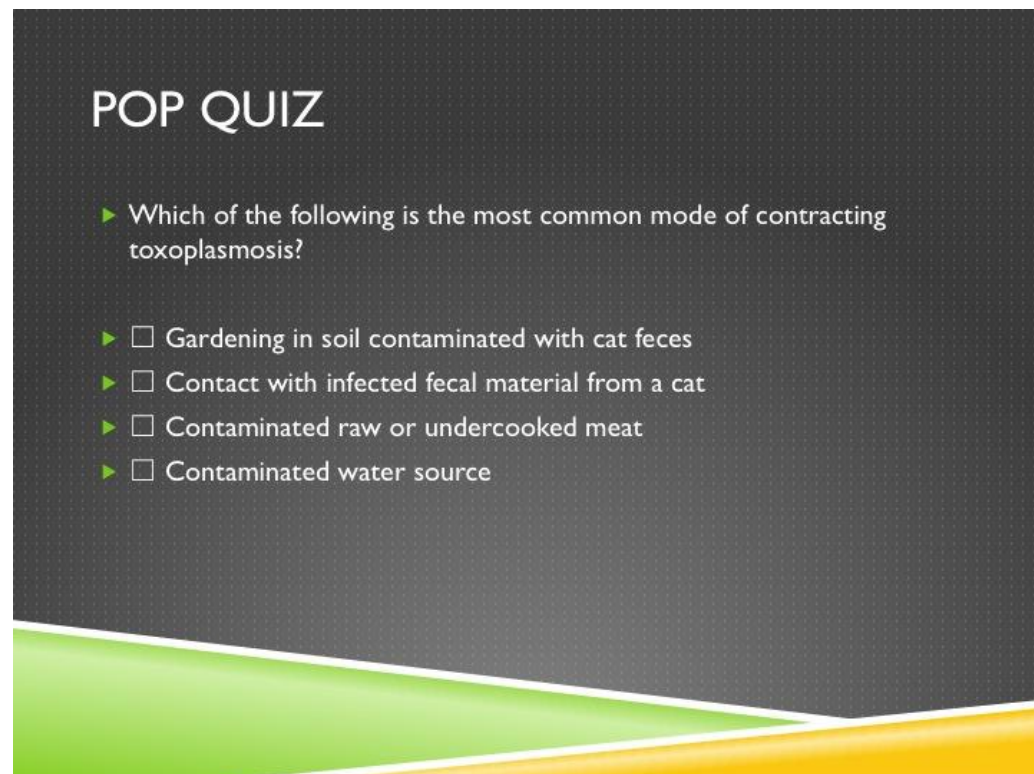
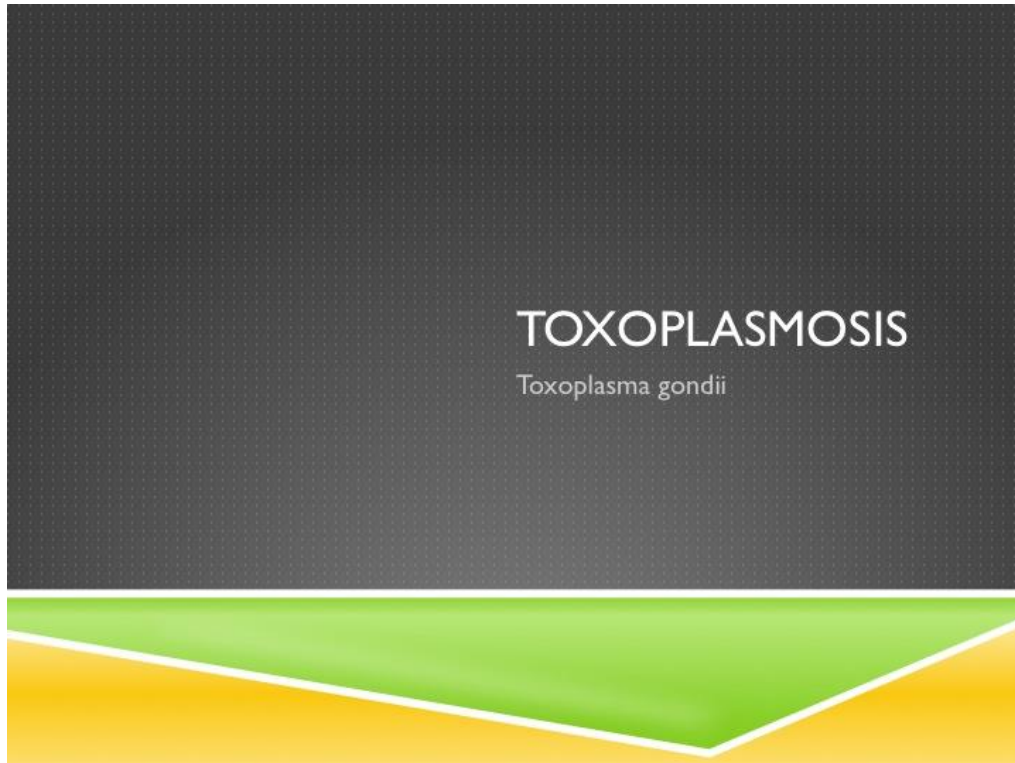
- ☐ Yes                      ☐ No

Do you think this survey might increase the likelihood of discussing the risks of toxoplasmosis with pregnant women or women planning to become pregnant?

- ☐ Yes                      ☐ No



## Appendix B - Educational PowerPoint



## POP QUIZ

- ▶ Which situation do you think poses the greatest risk for toxoplasmosis transmission?
  - ▶ ☐ A feral cat using a sand box as a litter box
  - ▶ ☐ A strictly indoor pet house cat
  - ▶ ☐ An indoor-outdoor pet cat
  - ▶ ☐ A newly adopted kitten

## POP QUIZ

- ▶ Which of the following can help to prevent infection with *Toxoplasma gondii*?
  - ▶ ☐ Hand washing
  - ▶ ☐ Daily cleaning of litter boxes
  - ▶ ☐ Wearing gloves during gardening
  - ▶ ☐ Cooking meat completely in accordance with CDC recommendation
  - ▶ ☐ Washing all produce thoroughly
  - ▶ ☐ Re-homing any pet cats

## POP QUIZ

- ▶ What should you do if you are concerned about the risks associated with *Toxoplasma gondii* and owning a pet cat?
- ▶ ☐ To re-home the cat
- ▶ ☐ To avoid contact with cat feces
- ▶ ☐ To switch the cat to an all outdoor lifestyle

## POP QUIZ

- ▶ How long does it take for *Toxoplasma gondii* oocysts to become infective?
- ▶ ☐ 24 hours
- ▶ ☐ 3-5 days
- ▶ ☐ 10 days

## POP QUIZ

- ▶ How long do viable *Toxoplasma gondii* oocysts remain infective in the soil environment?
- ▶ ☐ 24 hours
- ▶ ☐ Up to 18 months
- ▶ ☐ More than 5 years

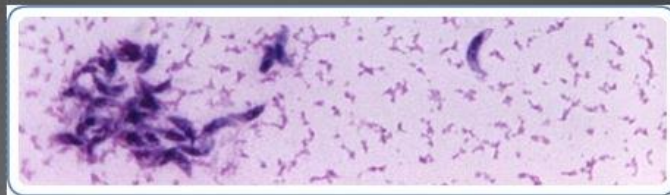
## POP QUIZ

- ▶ For how long do cats shed *Toxoplasma gondii* oocysts in their feces?
- ▶ ☐ For life
- ▶ ☐ 6 months
- ▶ ☐ 2 weeks



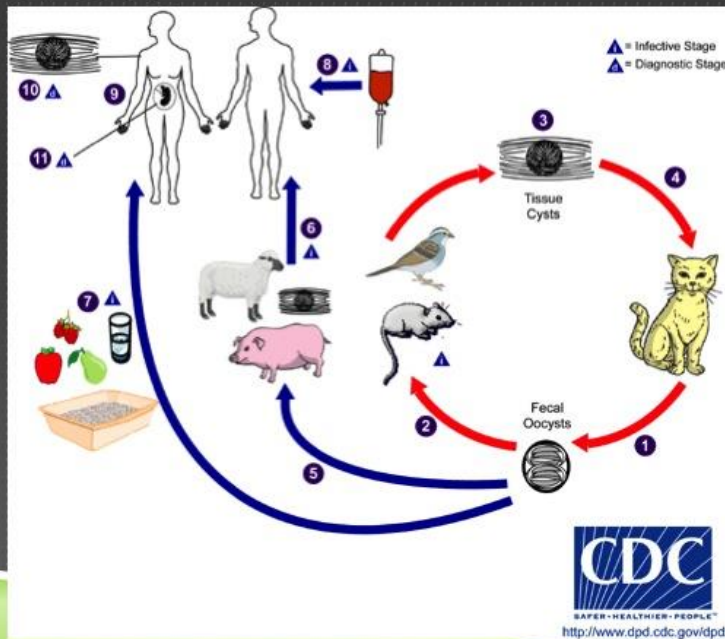
# WHAT IS TOXOPLASMOSIS?

- ▶ Caused by *Toxoplasma gondii*
  - ▶ A single-celled parasite
- ▶ Second most deadly foodborne illness known
- ▶ Can be found throughout the world<sup>3,4</sup>



<http://www.cdc.gov/parasites/toxoplasmosis/>

## LIFE CYCLE



## HOW DO I GET TOXOPLASMOSIS?

- ▶ Most commonly contracted by eating raw or undercooked meat
  - ▶ Especially pork, mutton, and venison<sup>4</sup>
- ▶ Feces of cats
  - ▶ Small window to become infected
    - ▶ Shed in feces for two weeks only<sup>4</sup>
- ▶ Unwashed vegetables<sup>4</sup>
- ▶ Contaminated utensils<sup>4</sup>



<http://www.cdc.gov/parasites/toxoplasmosis/epi.html>

## HOW DO I GET TOXOPLASMOSIS?

- ▶ Unpasteurized goats milk<sup>4</sup>
- ▶ Raw or undercooked oysters, mussels, or clams<sup>4</sup>
- ▶ Gardening
  - ▶ Feral cats use garden beds as litter box
  - ▶ Toxoplasma gondii oocysts remain in soil for up to 18 months<sup>4</sup>



<http://paleo-diet-info.com/goats-milk-the-paleo-diet/>

## WHO IS AT RISK?

- ▶ Those with compromised immune systems
  - ▶ Pregnant women
    - ▶ Unborn child at risk
  - ▶ Immunosuppressed
  - ▶ AIDS patients
  - ▶ Chemotherapy patients
  - ▶ Young children and elderly<sup>3,4</sup>
- ▶ What about a healthy immune system?
  - ▶ Immune system is able to fight the infection
  - ▶ May experience no symptoms to flu like symptoms for a few days to months<sup>3,4</sup>

## WHAT ARE THE SIGNS/SYMPTOMS?

- ▶ Flu-like symptoms
  - ▶ Swollen lymph nodes
  - ▶ Achy muscles<sup>4</sup>
- ▶ Severe toxoplasmosis
  - ▶ Occurs when a previous infection becomes reactivated because of immune depression
    - ▶ Damage to the eyes, brain, and other organs<sup>4</sup>
- ▶ Ocular toxoplasmosis
  - ▶ Reduced or blurred vision
  - ▶ Redness of the eye
  - ▶ Tearing<sup>4</sup>



## TREATMENT

- ▶ There is debate over whether treatment for toxoplasmosis is effective
- ▶ Medications used
  - ▶ Spiramycin<sup>4,5</sup>
  - ▶ Pyrimethamine/sulfadiazine<sup>4,5</sup>
- ▶ Spiramycin or Pyrimethamine/sulfadiazine are generally recommended for women who contract toxoplasmosis during pregnancy<sup>4,5</sup>

## HOW DOES TOXOPLASMOSIS AFFECT PREGNANT WOMEN?

- ▶ Mothers who become infected with *Toxoplasma* during or just before pregnancy are at risk of transmitting the parasite to their unborn child
- ▶ Infections early in pregnancy are less likely to be transmitted to the fetus than infections later in pregnancy
  - ▶ BUT...
- ▶ Early fetal infections are more likely to be clinically severe
- ▶ Can cause abortion or serious eye and brain defects<sup>4</sup>



## HOW CAN WE PREVENT TOXOPLASMOSIS?



<http://www.cdc.gov/parasites/toxoplasmosis/epi.html>

- ▶ Cook all meat to safe temperatures
  - ▶ For whole cuts of meat, cook to at least 145 F at the center of the thickest point. Then allow the meat to rest for 3 minutes before consumption. For ground meat, cook to at least 165 F. For poultry, cook to at least 165 F and let whole poultry rest for 3 minutes. Freezing meat to temperature below 0 F before cooking greatly reduces the chance of infection
- ▶ Wash or peel fruits and vegetables
- ▶ Don't drink unpasteurized goats milk
- ▶ Do not eat raw or undercooked oysters, mussels, or clams
- ▶ Wash cutting boards, dishes, counters, utensils, and hands
- ▶ Wear gloves while gardening
- ▶ Wear gloves while changing litter box
- ▶ Change litter box daily
- ▶ Get someone else to change litter box if pregnant<sup>1,4</sup>

## CAN I BE TESTED?



<http://www.cdc.gov/parasites/toxoplasmosis/epi.html>

- ▶ Yes!
- ▶ Tests for antibody titers
  - ▶ If you have an antibody titer it means your immune system has been exposed before and made memory antibodies to fight the infection<sup>2,4</sup>
- ▶ Positive test means your immune system is keeping the infection in check
  - ▶ Are not at risk of passing toxoplasmosis to an unborn child<sup>2,4</sup>
- ▶ Negative test means you have never been exposed<sup>2,4</sup>

## POP QUIZ - ANSWERS

- ▶ Which of the following is the most common mode of contracting toxoplasmosis?
  - ▶ ☐ Gardening in soil contaminated with cat feces
  - ▶ ☐ Contact with infected fecal material from a cat
  - ▶ ☒ Contaminated raw or undercooked meat
  - ▶ ☐ Contaminated water source

## POP QUIZ - ANSWERS

- ▶ Which situation do you think poses the greatest risk for toxoplasmosis transmission?
  - ▶ ☒ A feral cat using a sand box as a litter box
  - ▶ ☐ A strictly indoor pet house cat
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## POP QUIZ - ANSWERS

- ▶ Which of the following can help to prevent infection with *Toxoplasma gondii*?
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  - ▶ ☒ Wearing gloves during gardening
  - ▶ ☒ Cooking meat completely in accordance with CDC recommendation
  - ▶ ☒ Washing all produce thoroughly
  - ▶ ☐ Re-homing any pet cats

## POP QUIZ - ANSWERS

- ▶ What should you do if you are concerned about the risks associated with *Toxoplasma gondii* and owning a pet cat?
  - ▶ ☐ To re-home the cat
  - ▶ ☒ To avoid contact with cat feces
  - ▶ ☐ To switch the cat to an all outdoor lifestyle



## POP QUIZ – ANSWERS

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  - ▶ ☒ 24 hours
  - ▶ ☐ 3-5 days
  - ▶ ☐ 10 days

## POP QUIZ - ANSWERS

- ▶ How long do viable *Toxoplasma gondii* oocysts remain infective in the soil environment?
  - ▶ ☐ 24 hours
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## POP QUIZ - ANSWERS

- ▶ For how long do cats shed *Toxoplasma gondii* oocysts in their feces?
- ▶ ☐ For life
- ▶ ☐ 6 months
- ▶ ☒ 2 weeks

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